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Manaras

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(54) **SENSING MECHANISM FOR AN ASSISTED GARAGE DOOR**

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(51) **Int. Cl.**

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E06B 9/15	(2006.01)
E06B 9/70	(2006.01)
E06B 9/88	(2006.01)
E06B 9/68	(2006.01)

(Continued)

(52) **U.S. Cl.**

CPC . ***E05F 15/70*** (2015.01); ***E06B 9/15*** (2013.01); ***E06B 9/70*** (2013.01); ***E06B 9/88*** (2013.01); *E05F 15/41* (2015.01); *E05F 15/684* (2015.01); *E05Y 2900/00* (2013.01); *E05Y 2900/106* (2013.01); *E06B 2009/6818* (2013.01)

(58) **Field of Classification Search**

USPC 49/26, 28, 197, 199; 160/1, 8, 188; 474/110, 118, 136; 318/445, 450, 466, 318/468

See application file for complete search history.

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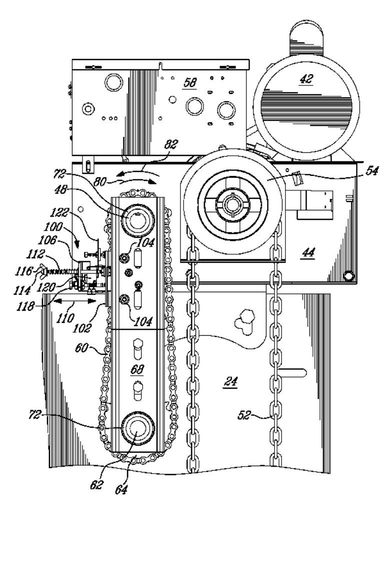
(57) **ABSTRACT**

A garage door opening module is disclosed, the module comprises a power unit having a rotatable output drive, an endless transmission drive adapted to transfer movement from the rotatable output drive to a door drive, and a sensor mechanism positioned along the endless transmission drive and adapted to sense a transmission drive slack, the sensor mechanism adapted to stop the power unit when a transmission drive slack displacement threshold is reached. A method for actuating a garage door and a sensor module for preventing movements of an assisted garage door are also disclosed.

20 Claims, 19 Drawing Sheets



(51) **Int. Cl.**
E05F 15/41 (2015.01)
E05F 15/684 (2015.01)

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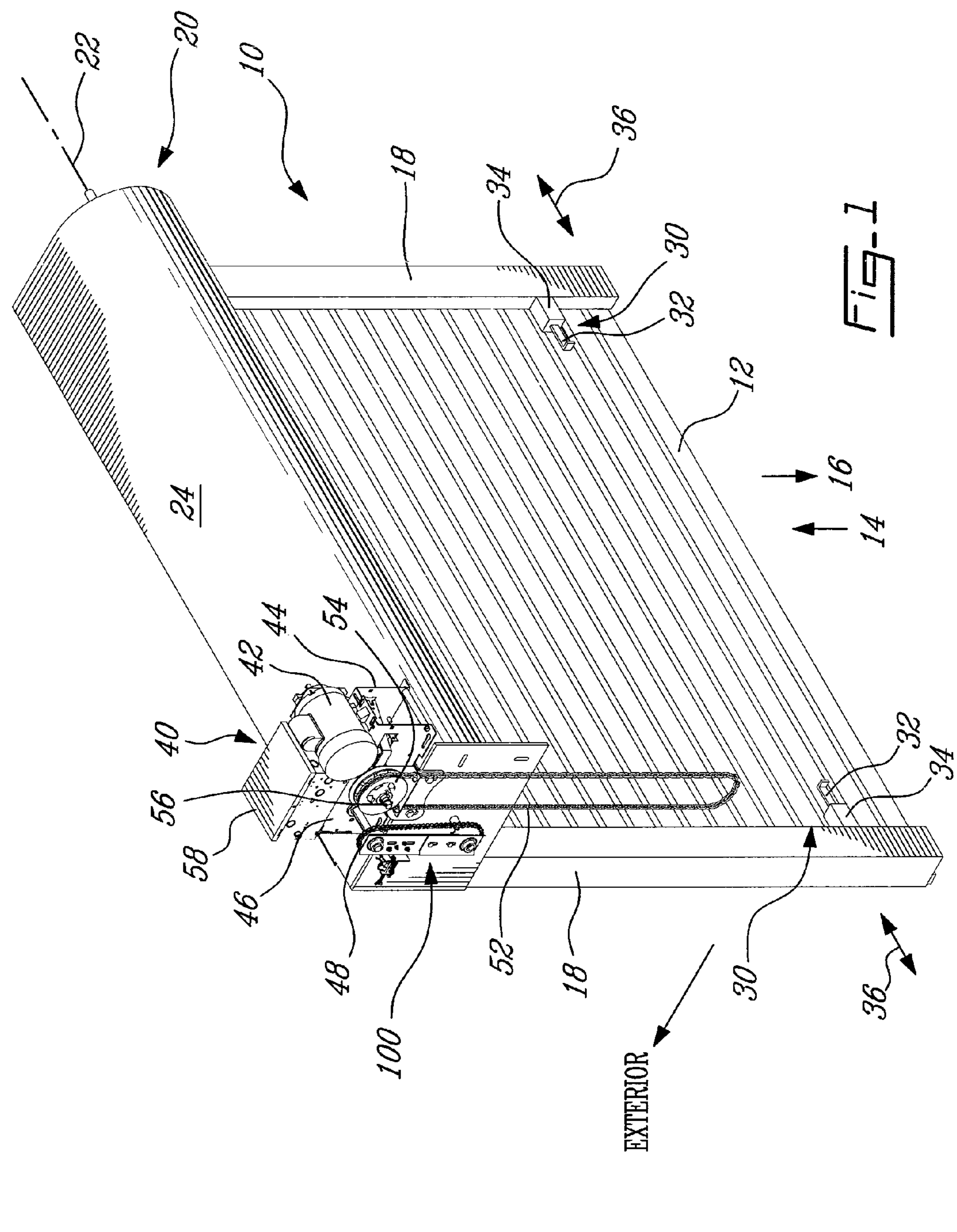

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Fig-1

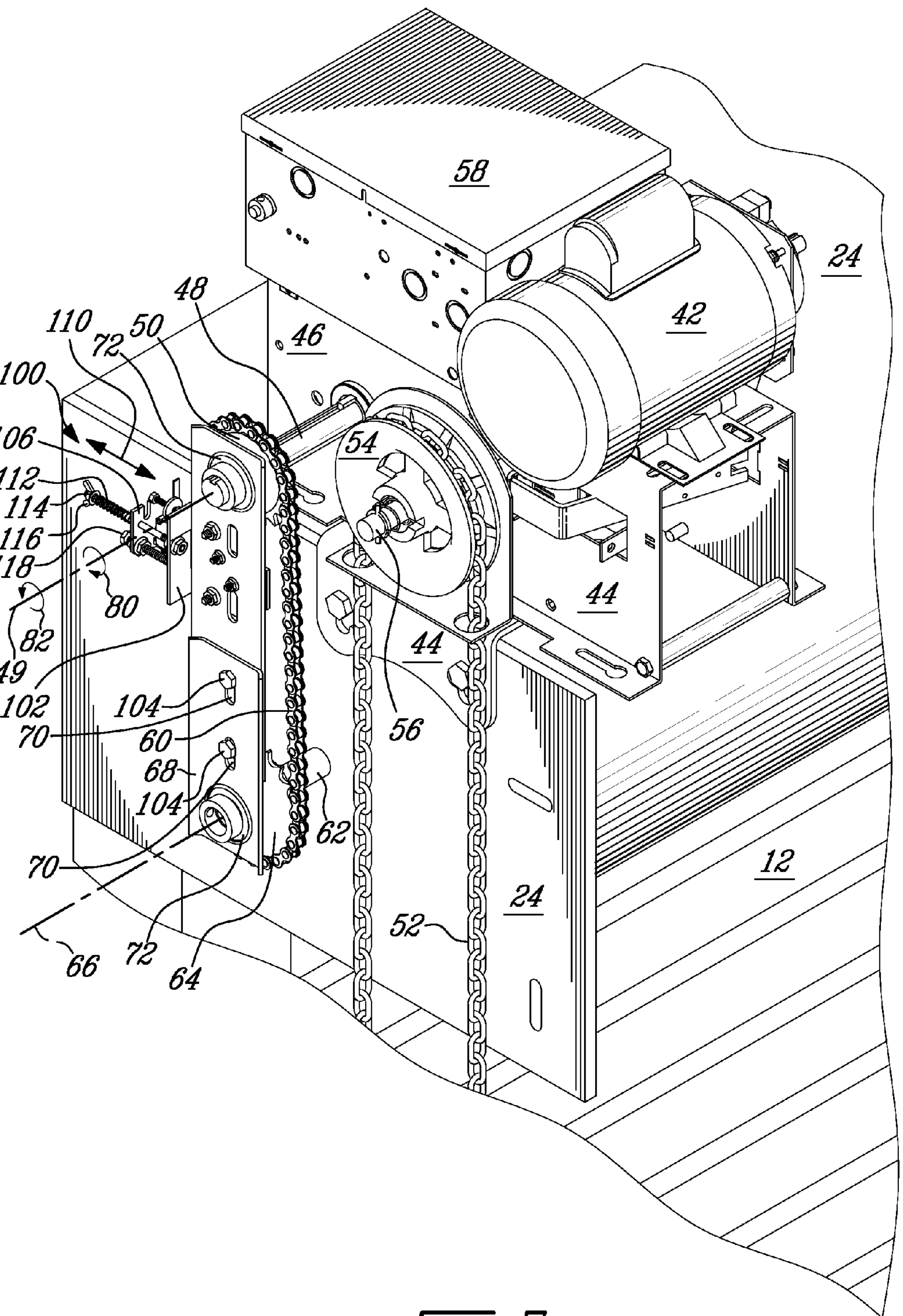
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Fig-2

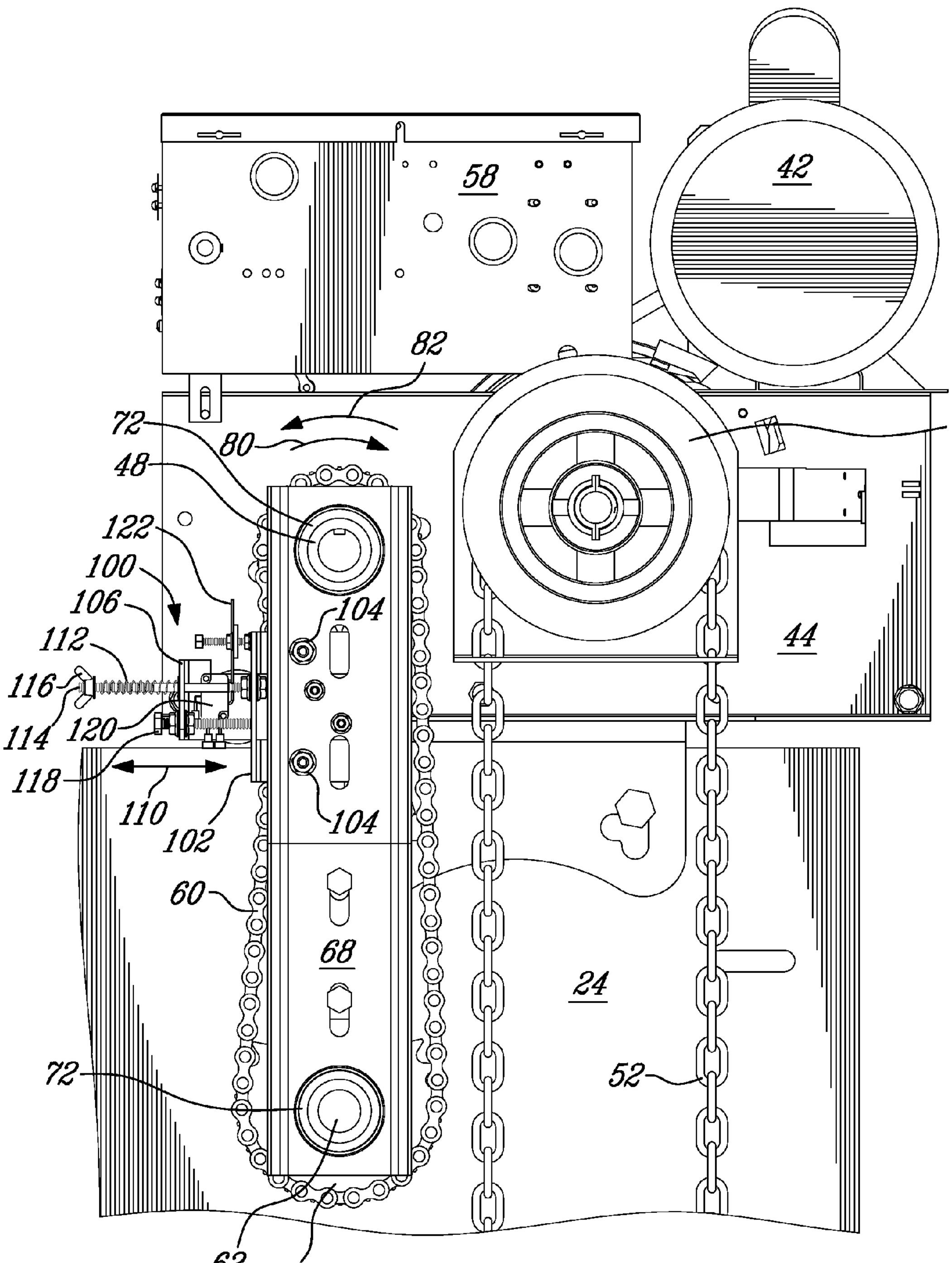
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Fig-3

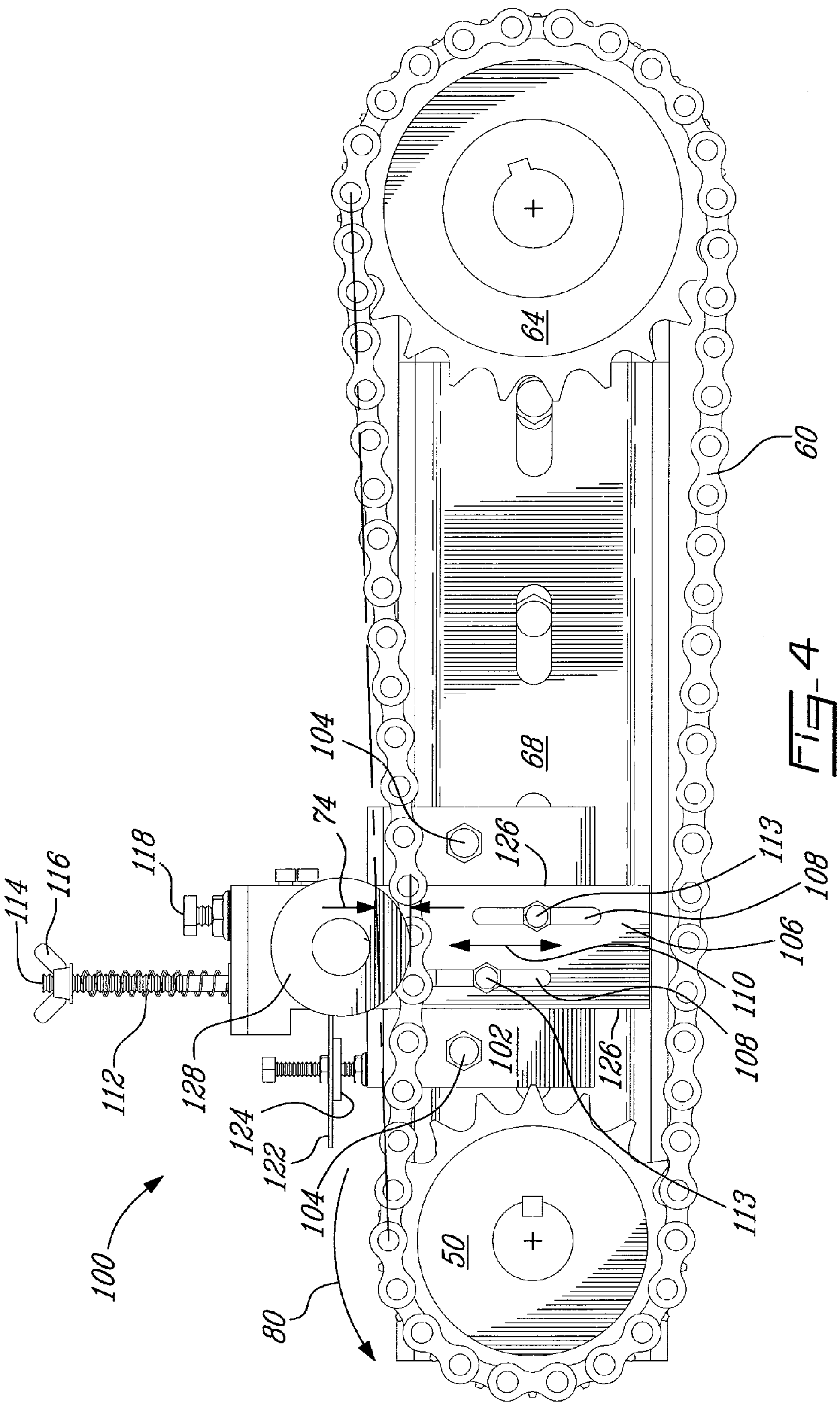
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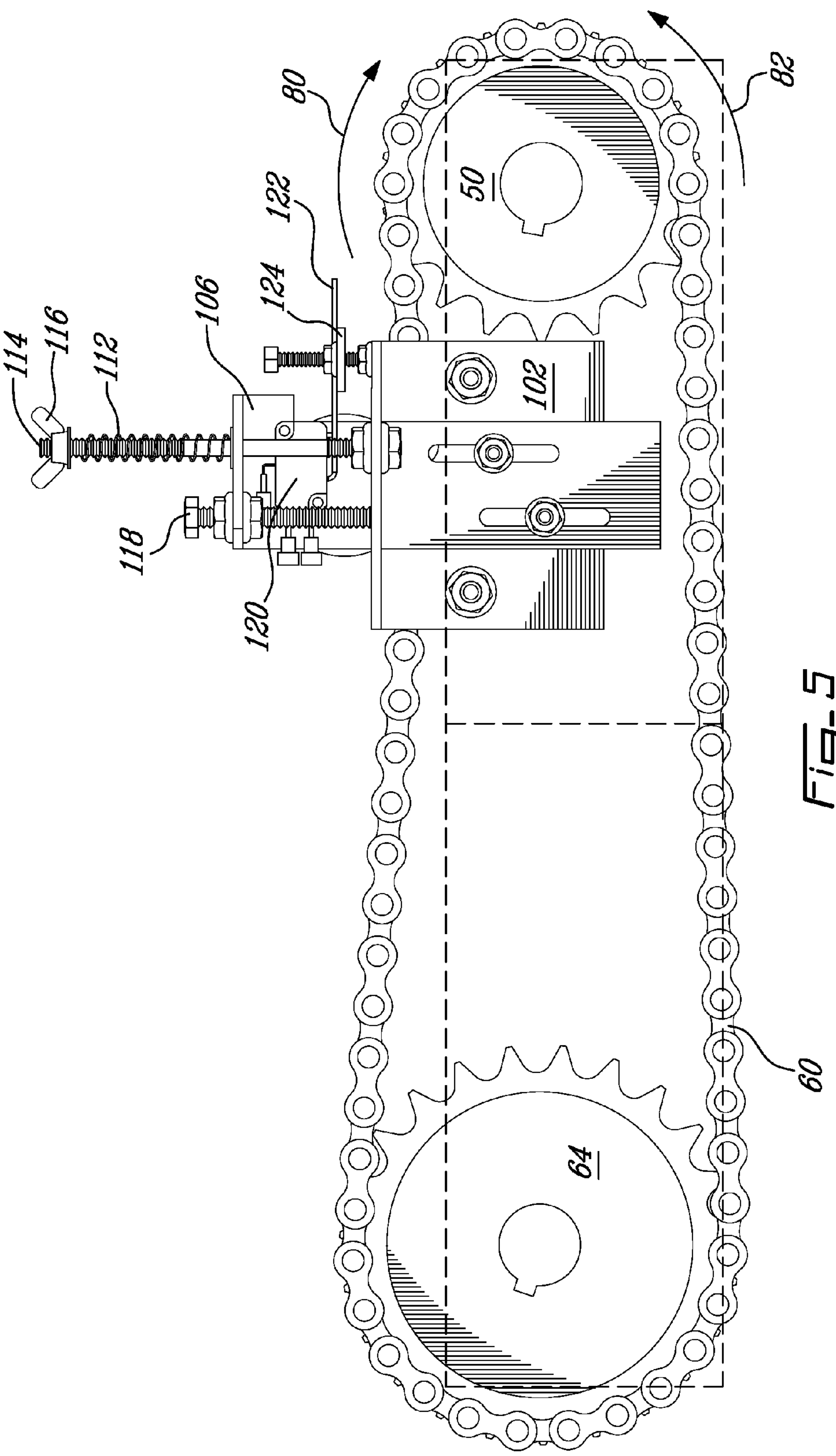
Fig-4



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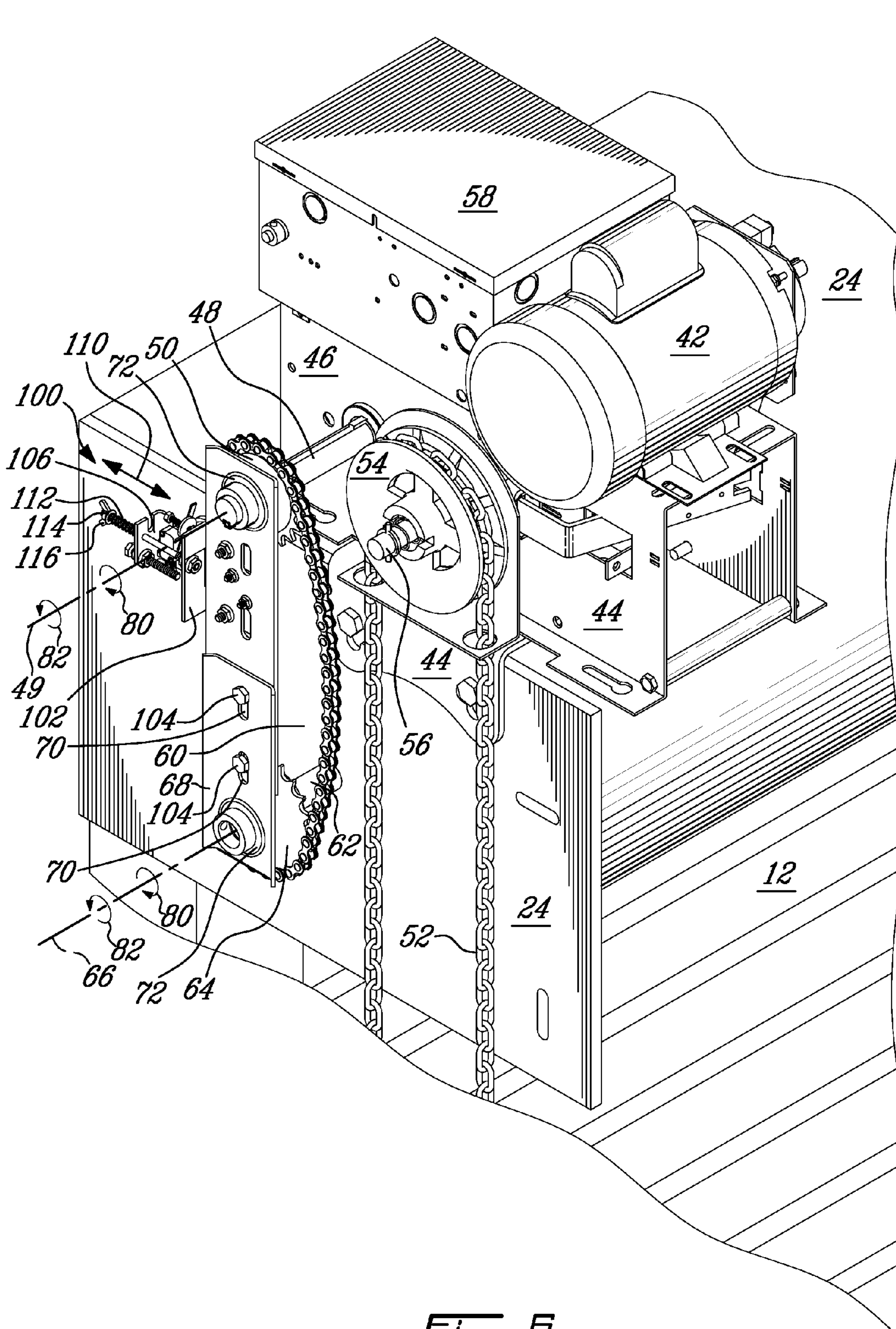

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Fig. 6

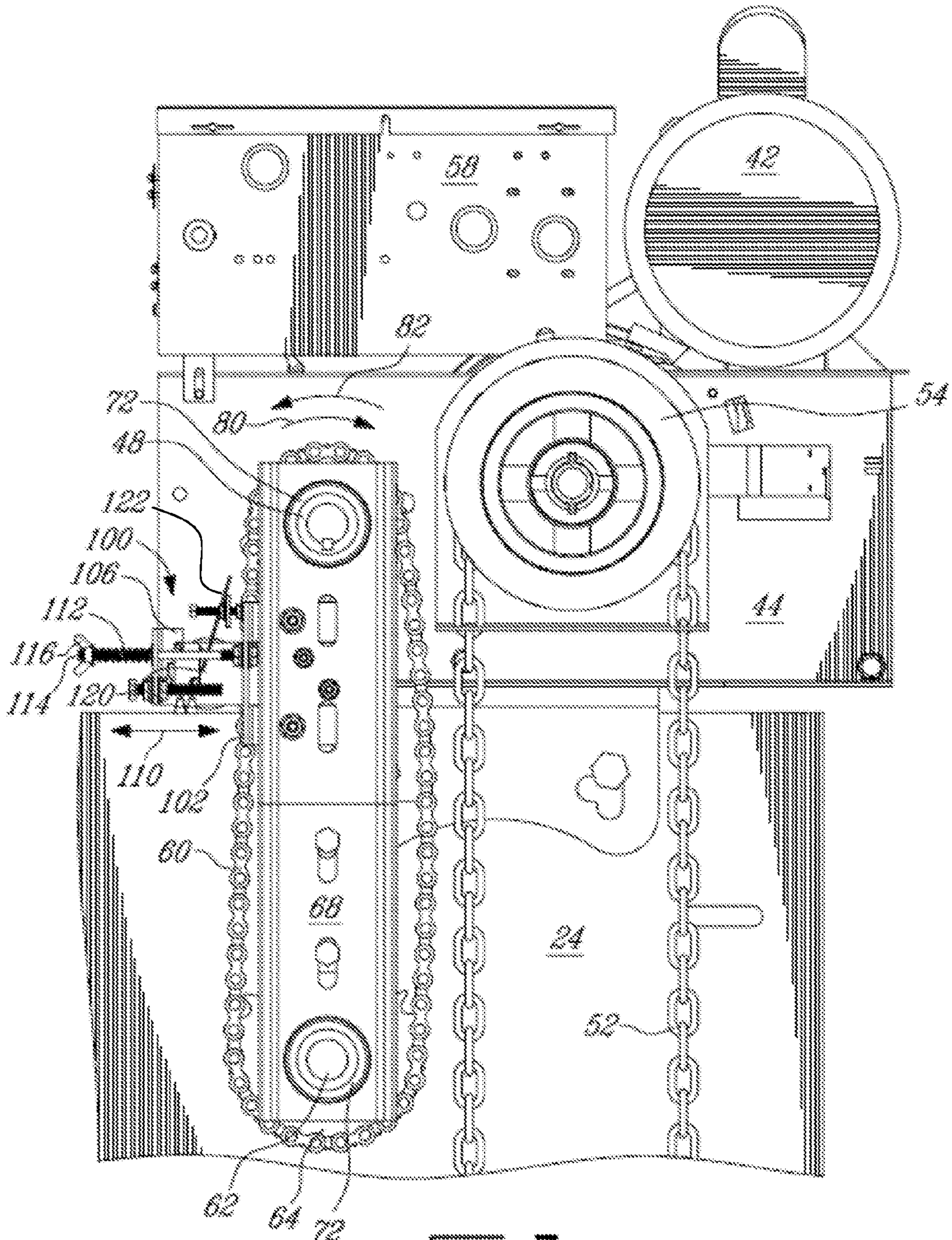
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FIG-7

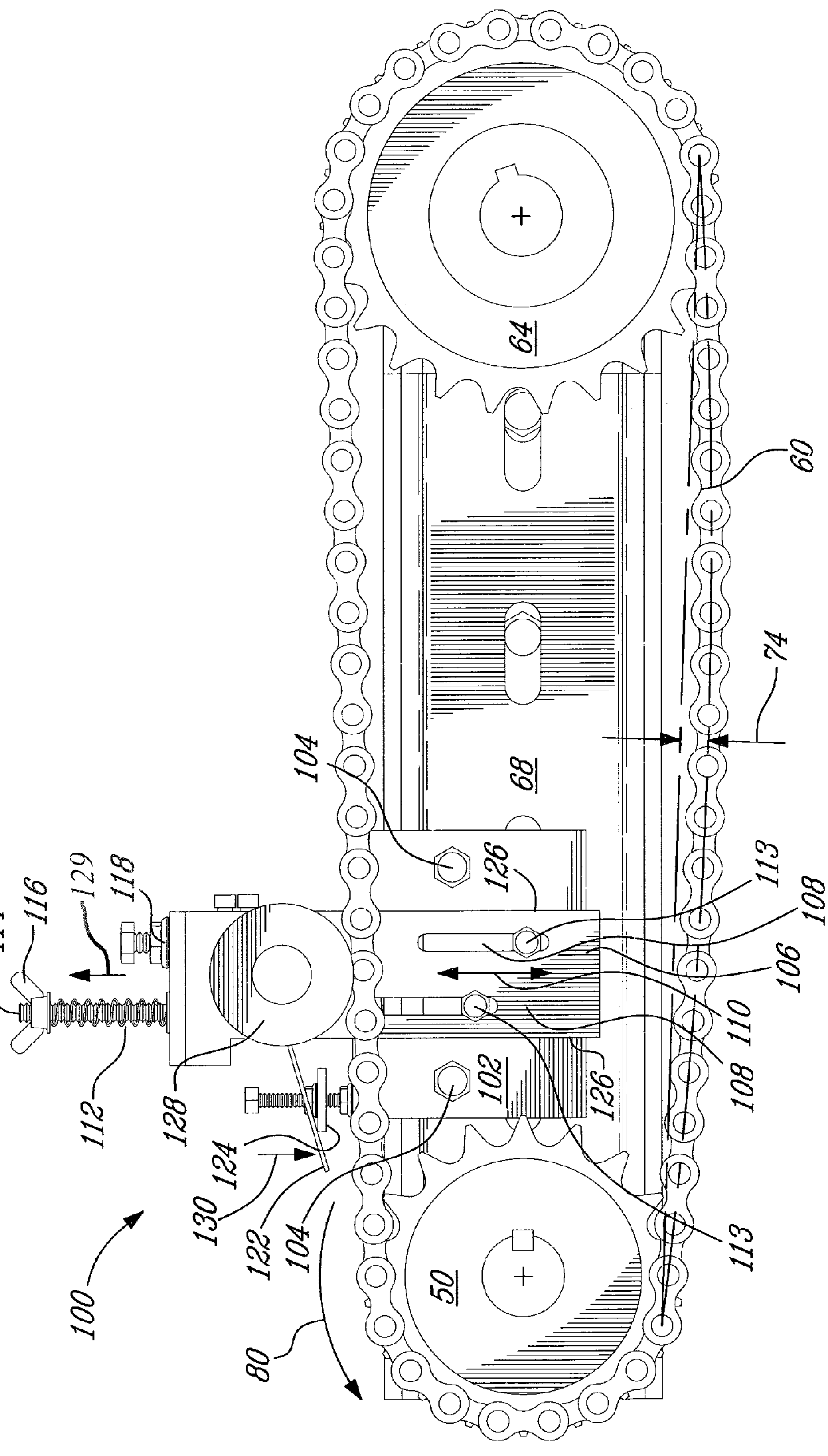
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Fig-8

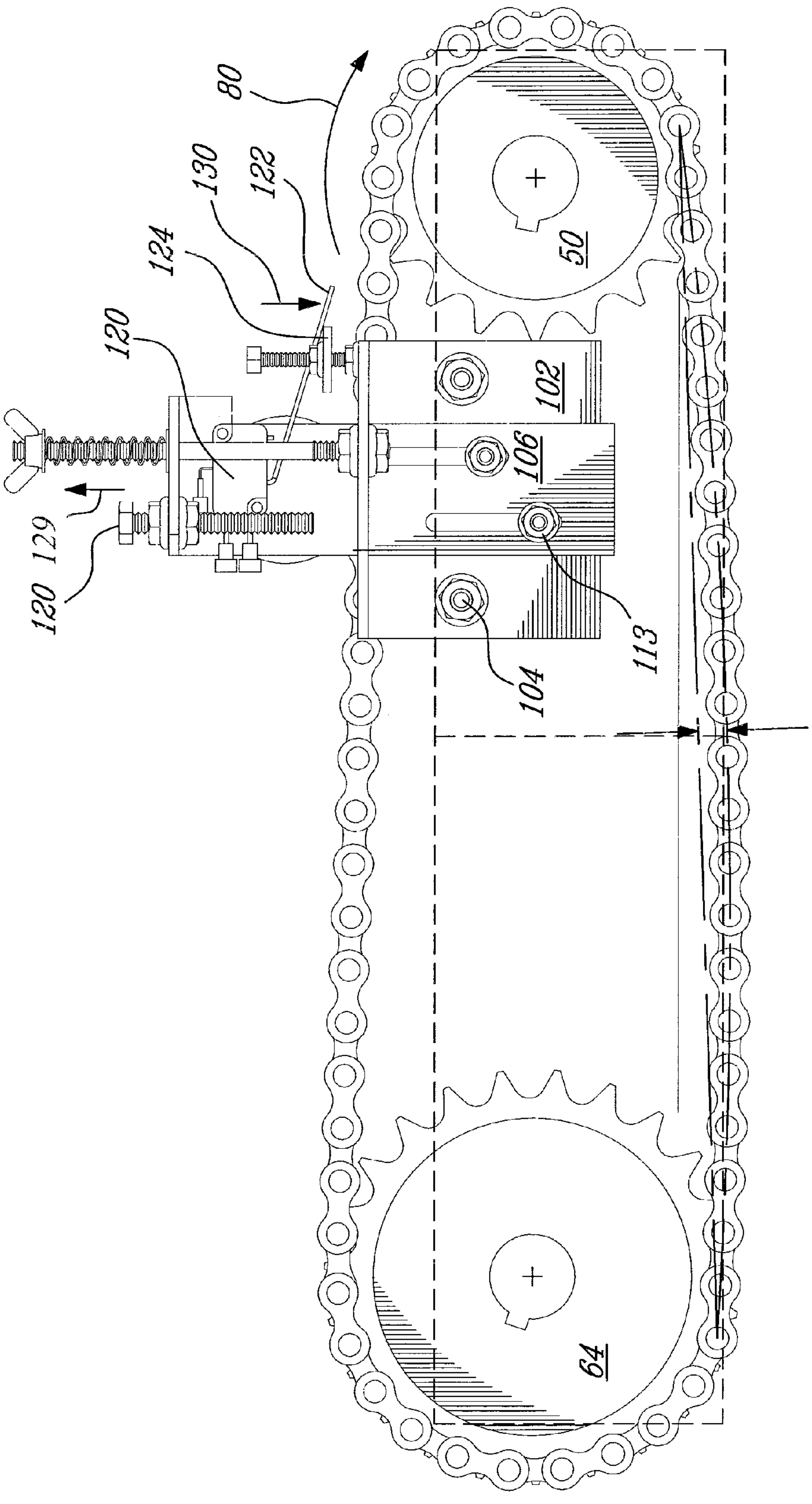

Fig-9

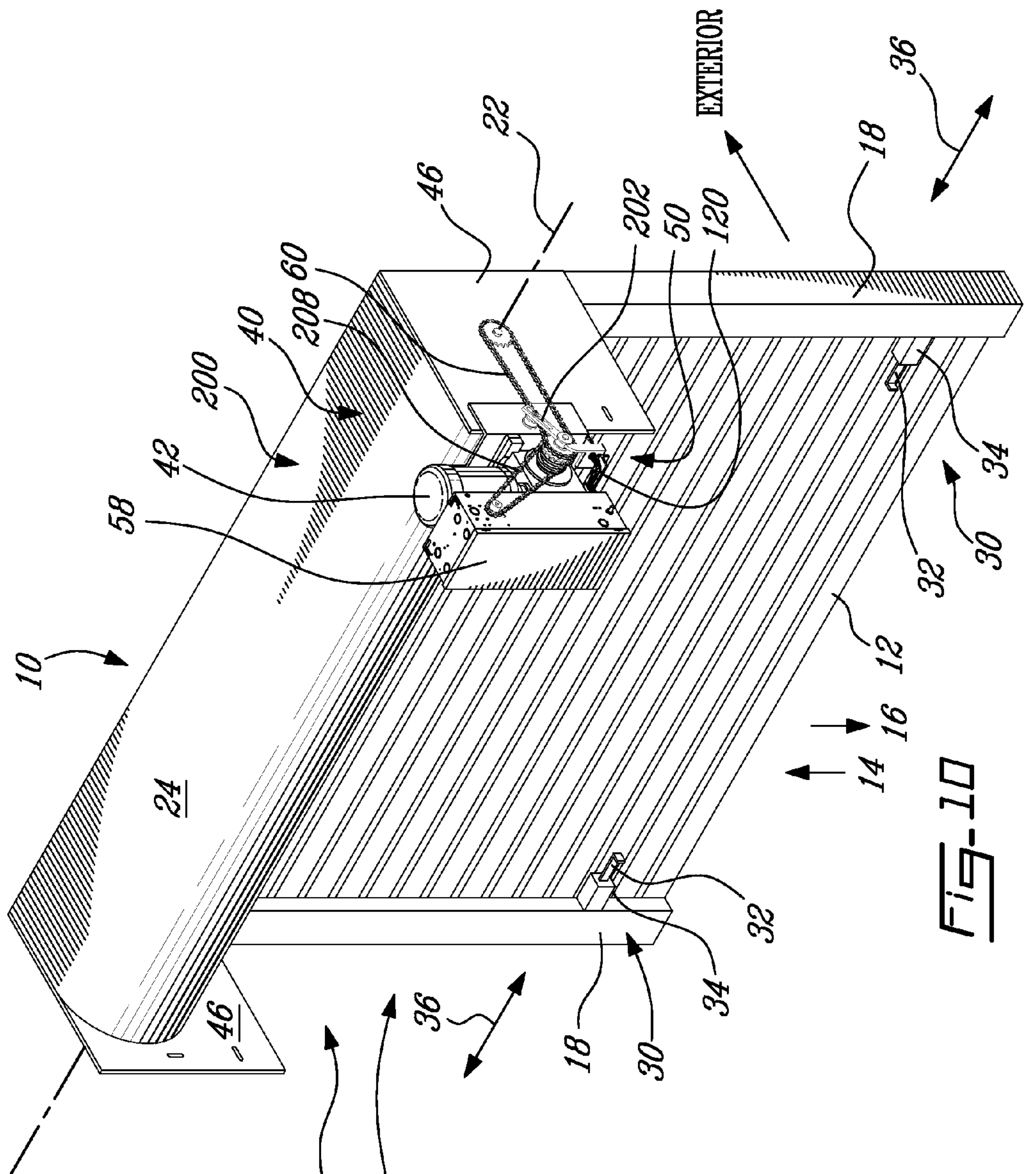
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Fig-10

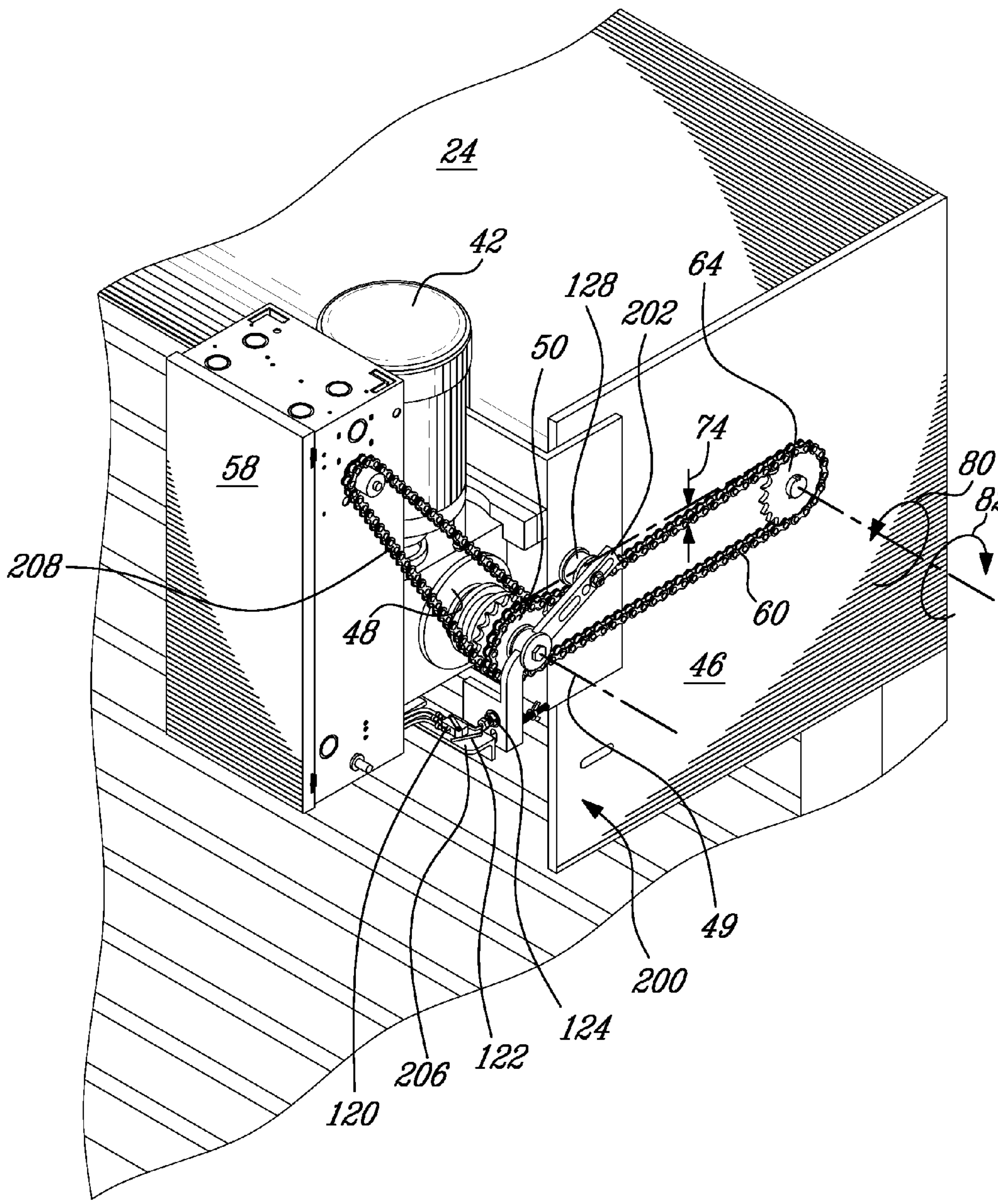

Fig-11

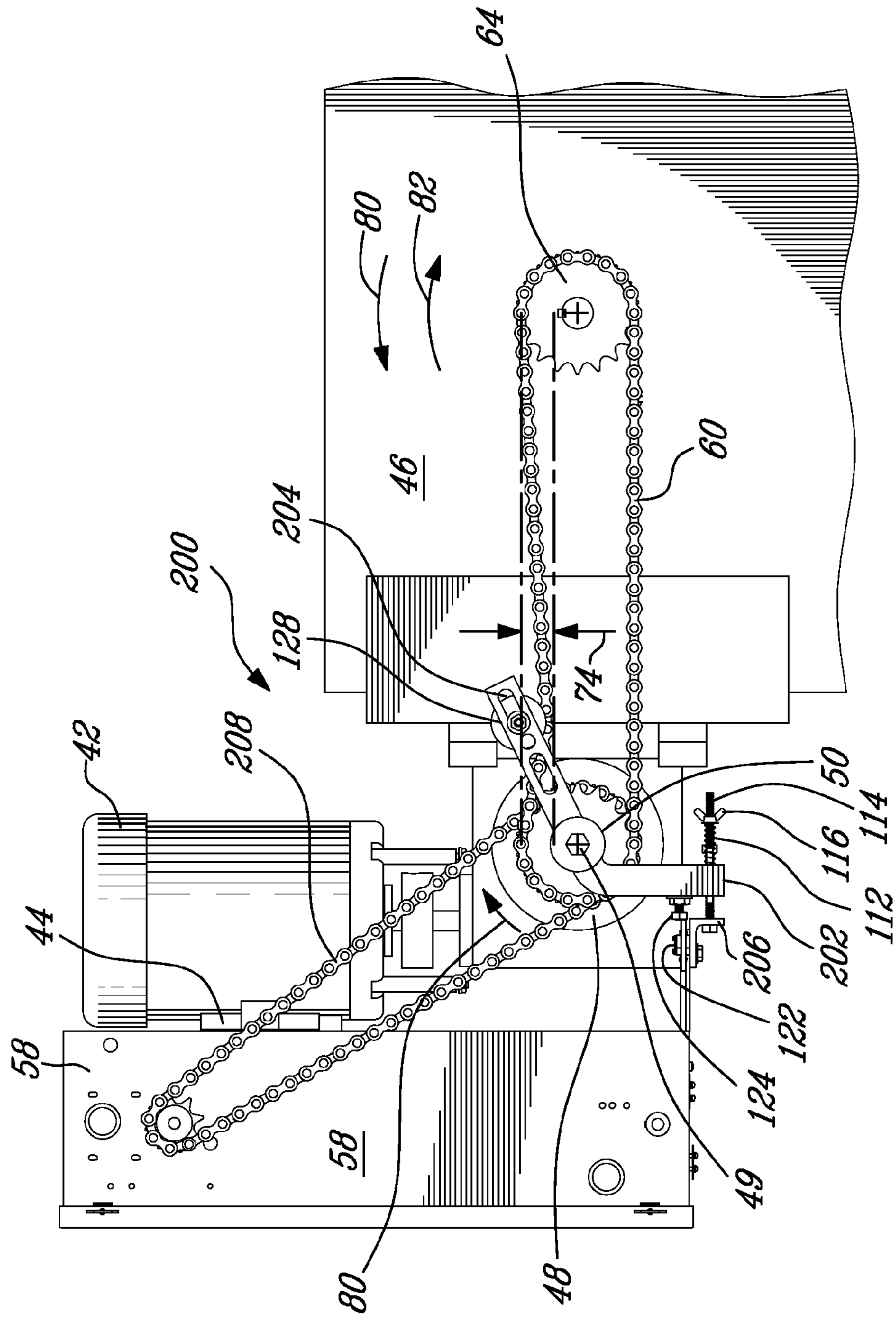
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Fig-12

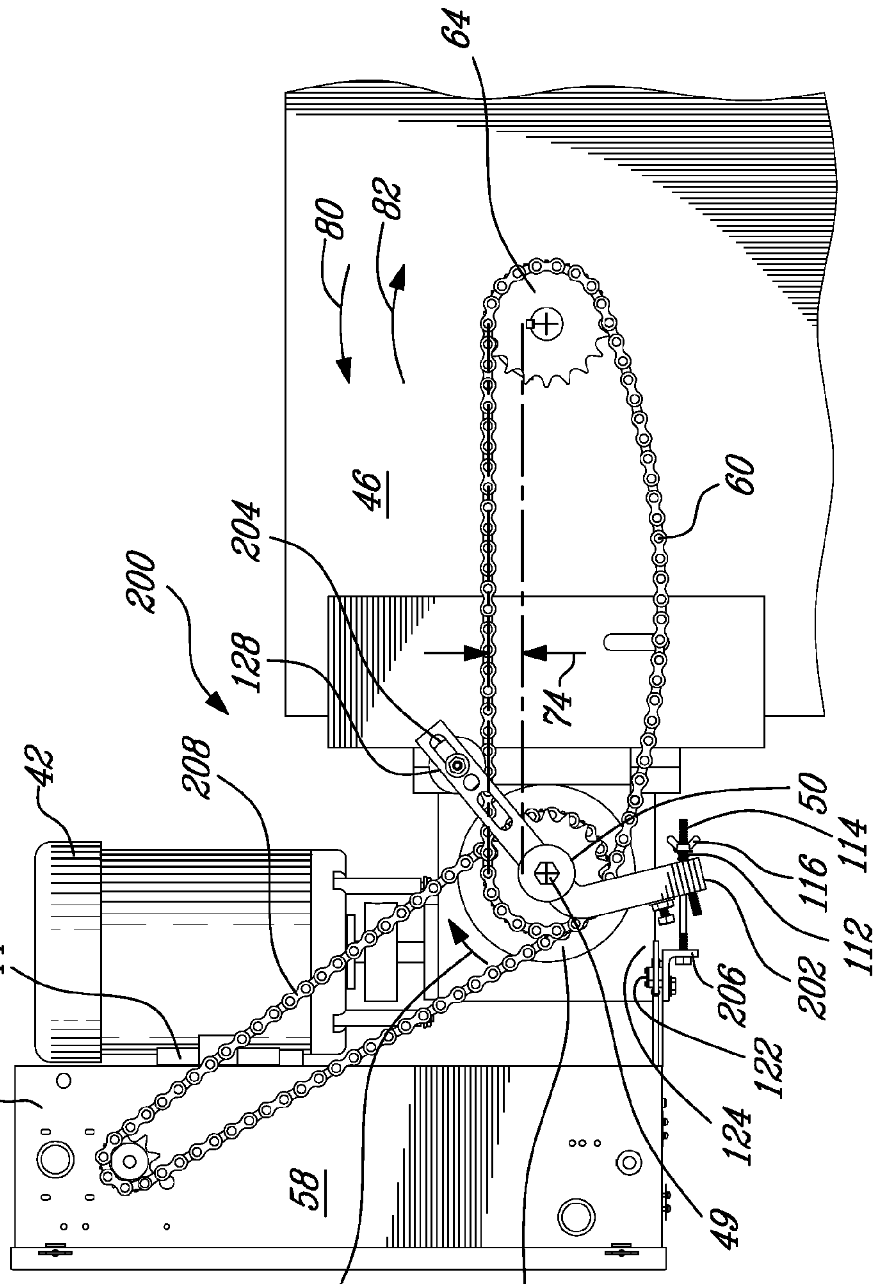
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Fig-13

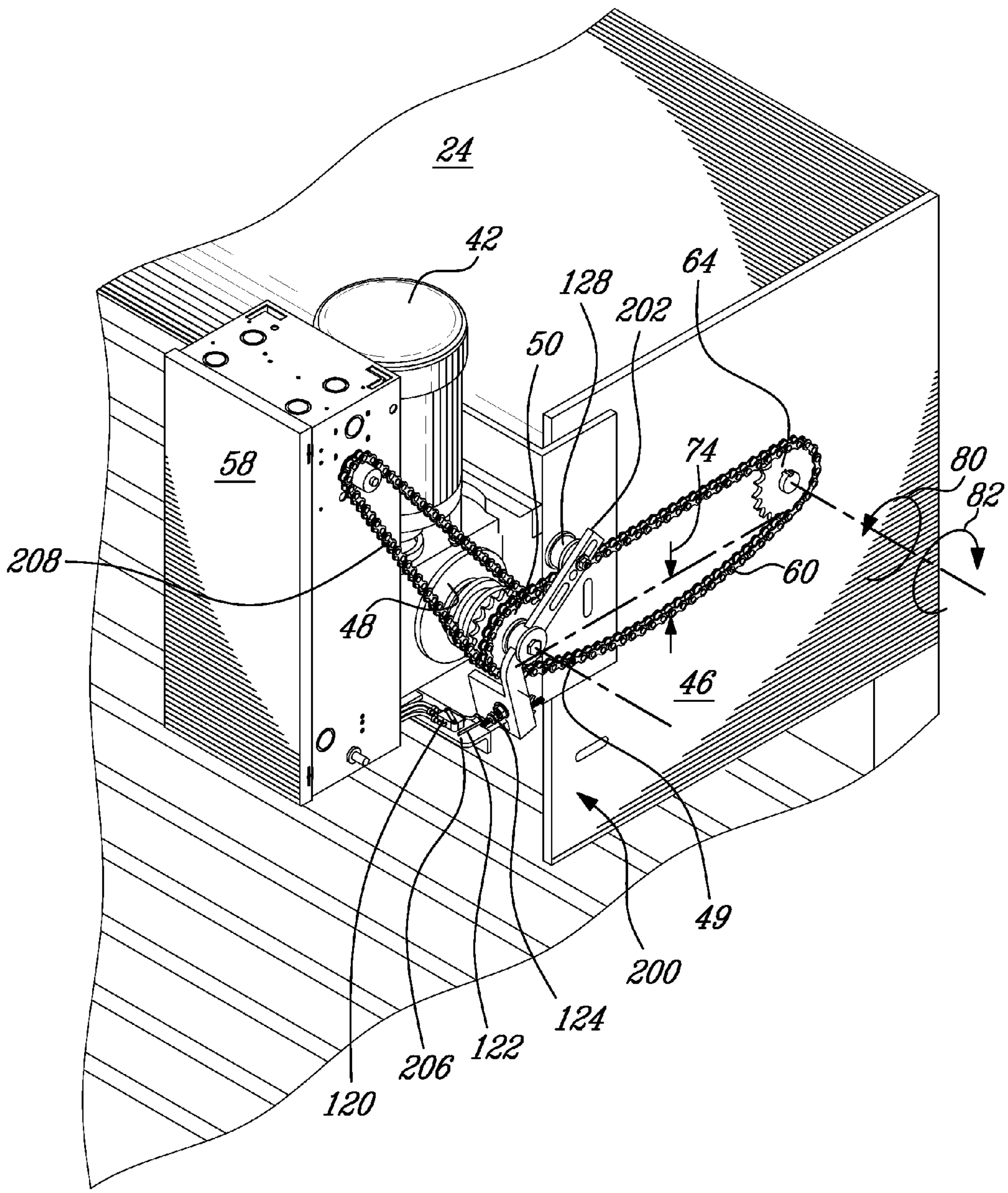

Fig-14

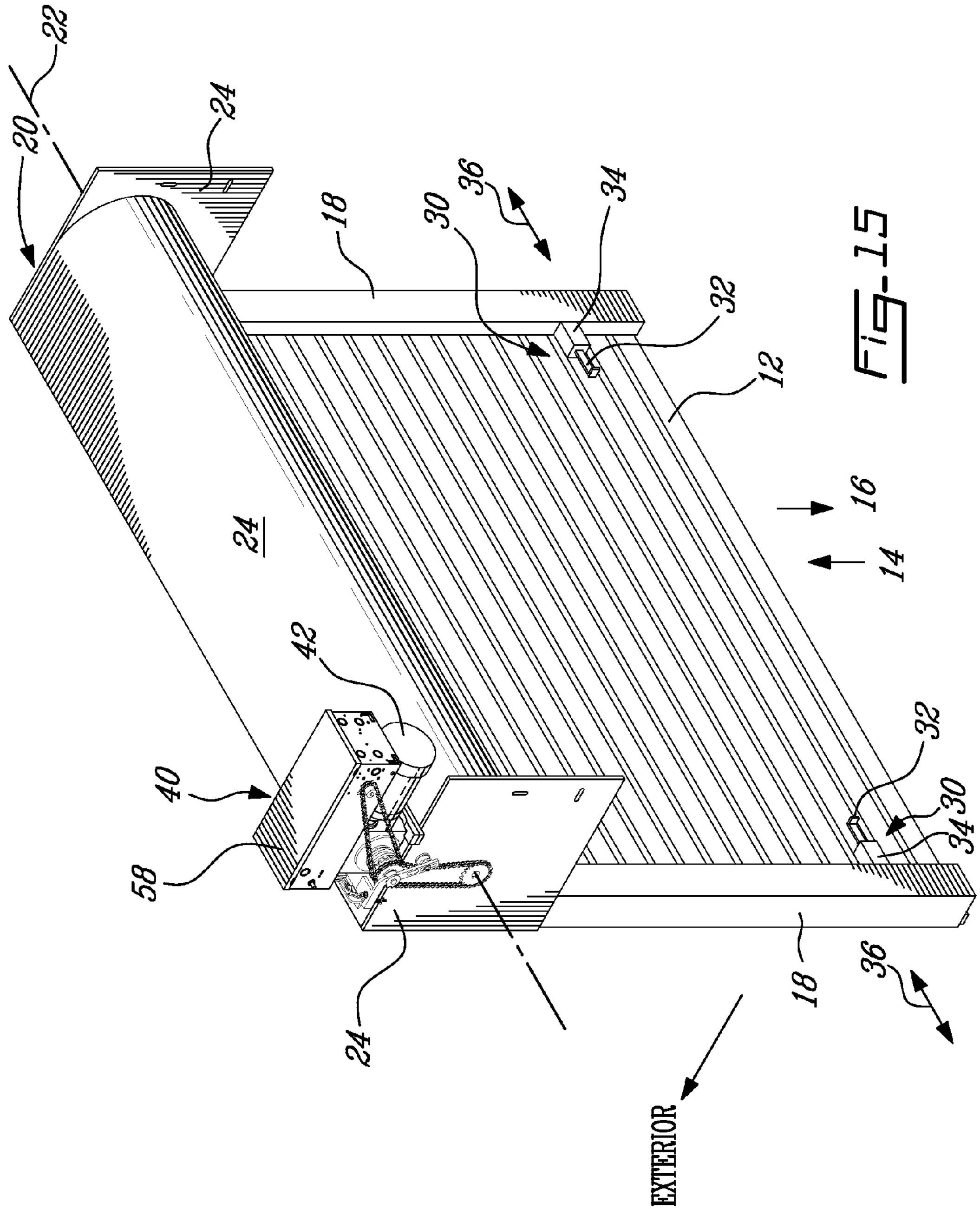
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Fig-15

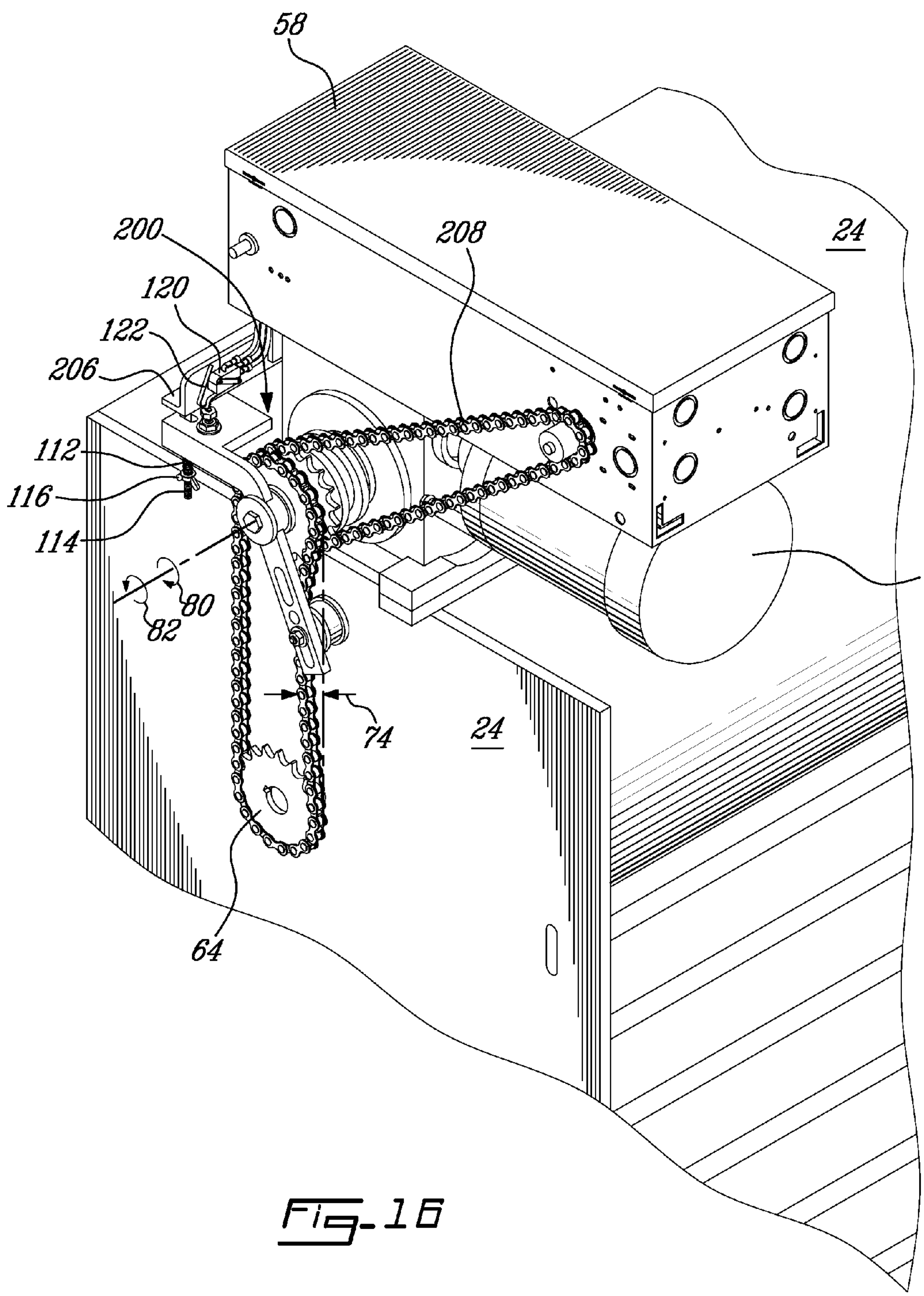

Fig-16

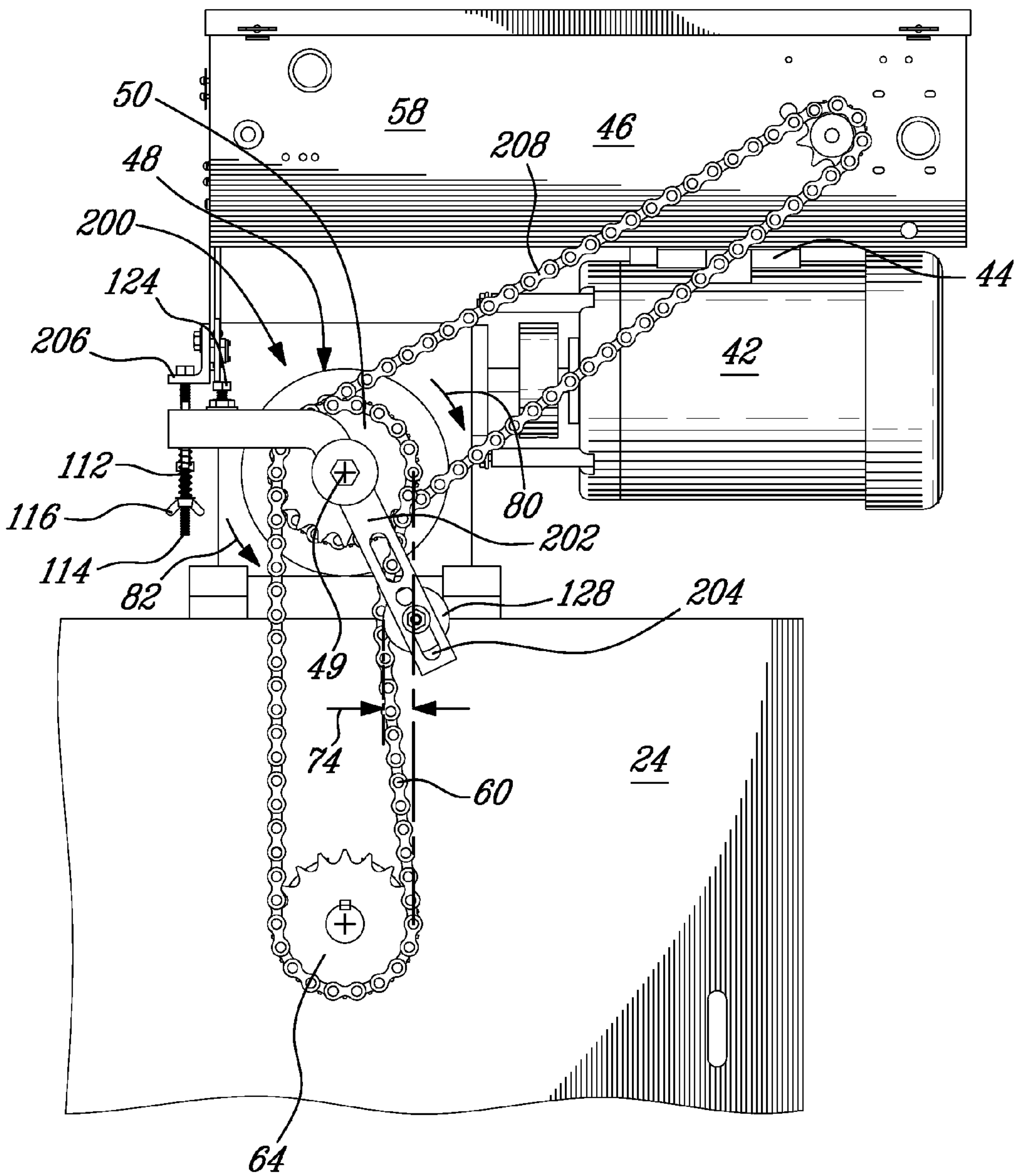
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Fig-17

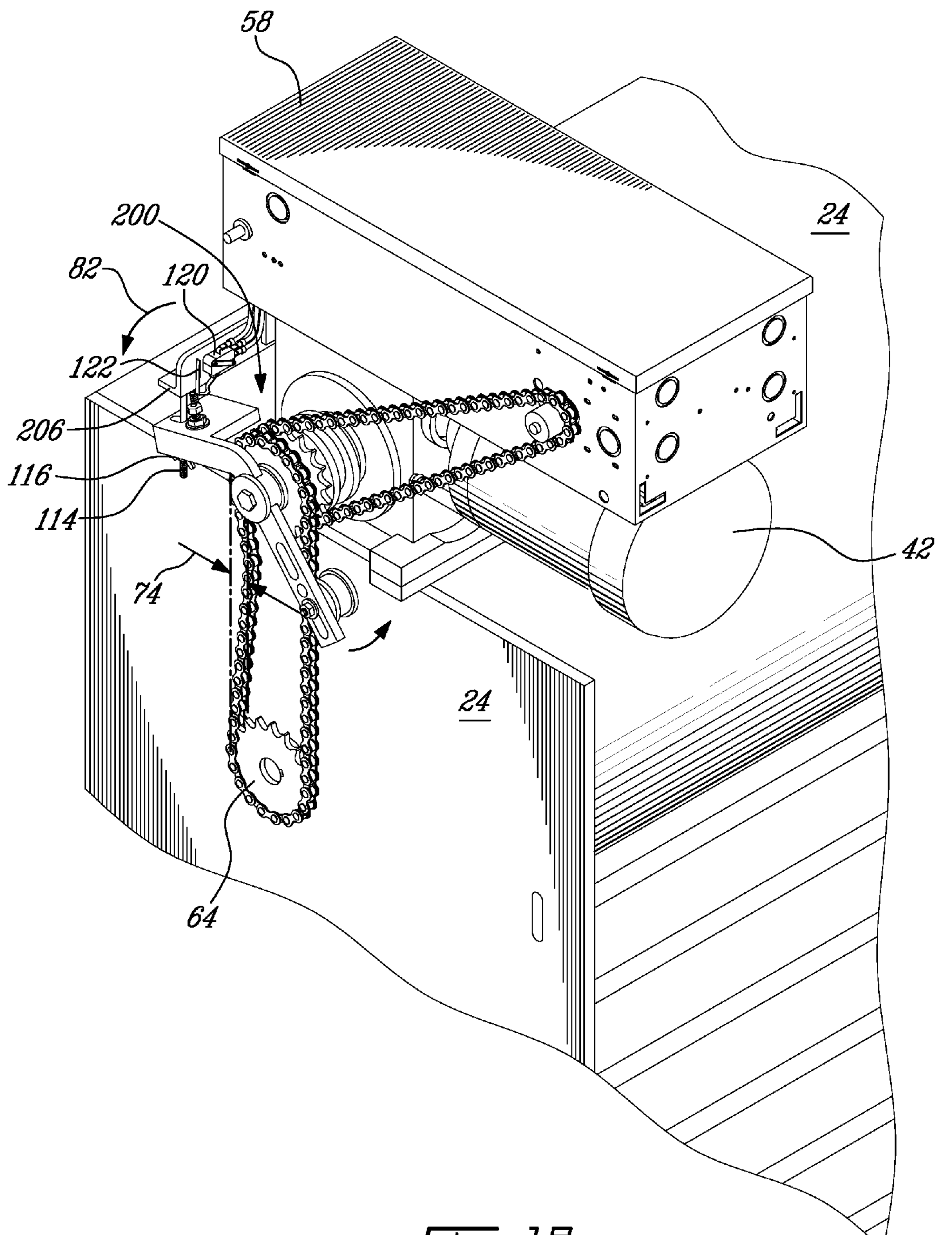

Fig-18

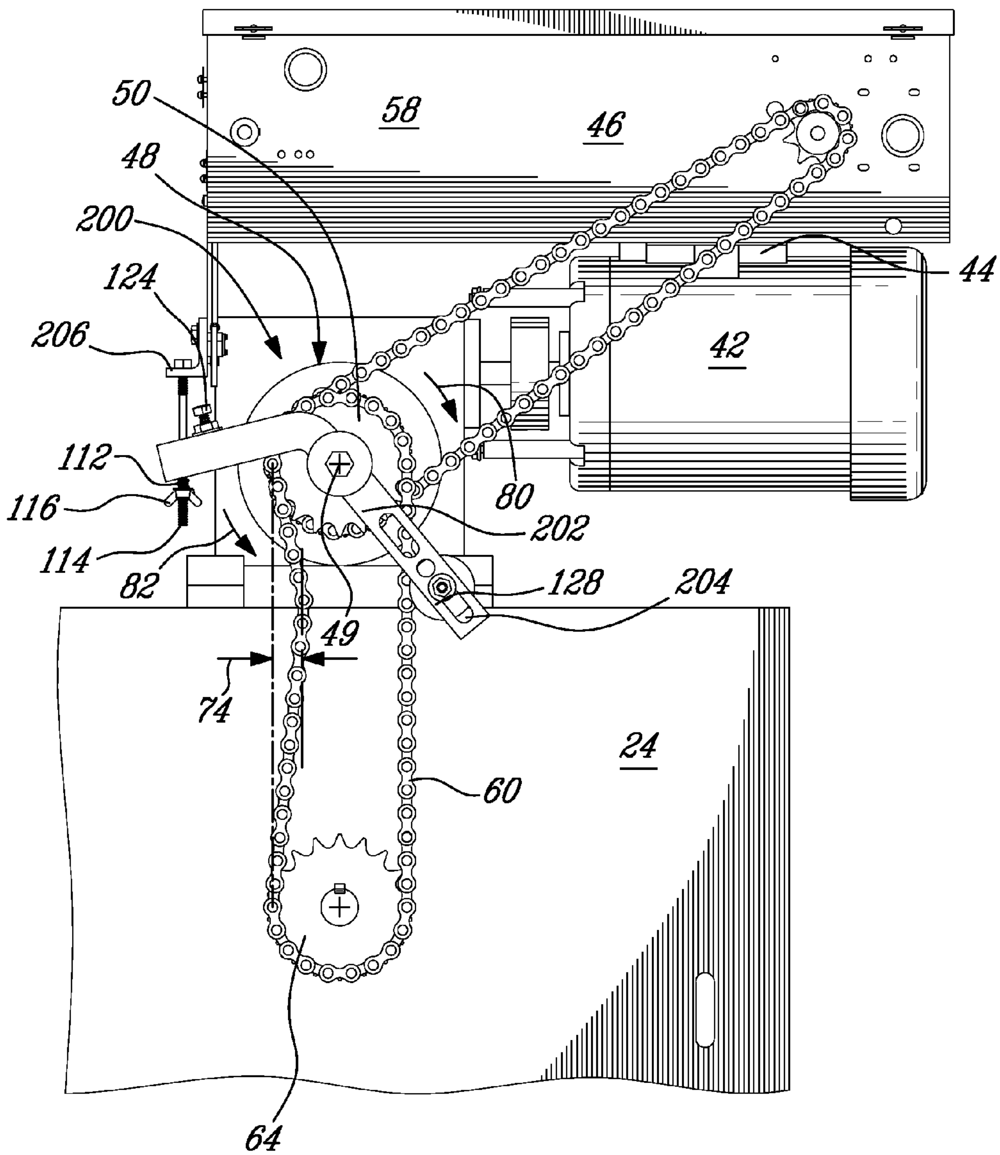
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Fig-19

SENSING MECHANISM FOR AN ASSISTED GARAGE DOOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation of U.S. patent application Ser. No. 12/430,615, filed on Apr. 27, 2009, which claims priority to Canadian Patent Application No. 2,629,828 filed on Apr. 25, 2008 and to U.S. Provisional Patent Application No. 61/071,498 filed on May 1, 2008, the entirety of both of these applications being herein incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to an assisted garage door closure mechanism. More precisely the present invention relates to a mechanism for sensing the force applied by the power unit of the assisted garage door closure mechanism.

BACKGROUND OF THE INVENTION

Assisted garage door opening mechanisms are used to automatically open a garage door without human intervention. They help to assist opening/closing garage doors or simply allow remote actuation of a garage door (e.g. from inside the car with a wireless transmitter).

The assisted garage door opening mechanism is commonly installed inside the garage and is mechanically connected to the garage door to alternatively move the garage door up and down.

A locking mechanism is usually installed on the garage door to manually lock the garage door in a closed position and secure the goods stored in the garage. The locking mechanism can be a simple steel rod secured to the garage door and selectively engaging an associated opening in a garage door-frame thus preventing the garage door from opening.

The locking mechanism, when engaged, prevents people outside the garage to open the door but also prevents the assisted garage door opening mechanism to open the garage door. The assisted garage door opening mechanism will force against the locking mechanism if the assisted garage door opening mechanism is activated when the garage door is locked. This happens because the assisted garage door opening mechanism cannot make the difference between a locked and unlocked garage door.

Known assisted garage door opening mechanisms can be equipped with end-of-travel sensors. An end-of-travel sensor senses when the garage door reaches its opened position and another end-of-travel sensor senses when the garage door reaches its closed position. The opened position end-of-travel sensor sends a signal to the assisted garage door opening mechanism to stop opening the garage door. In contrast, the closed position end-of-travel sensor sends a signal to the assisted garage door opening mechanism to stop closing the garage door. In both situations the movement of the garage door is stopped because it has reached its desired position. Unfortunately, these end-of-travel sensors are not helpful in preventing the assisted garage door opening mechanism to try to open a locked garage door because the garage door is already in its closed position. The closed position end-of-travel sensor being already activated and the open position end-of-travel sensor being not activated the assisted garage door opening mechanism infers it can move the garage door upward despite the garage door might be locked.

Therefore, a need has been found for an improved garage door opening mechanism. Similarly, a need has arisen for an improved garage door opening mechanism that will not enable to move a locked garage door or a garage door that is blocked. There is also a need for a retrofit module that can be added to a garage door opening mechanism to prevent the garage door to open a locked garage door.

SUMMARY OF THE INVENTION

An aspect of the present invention provides a novel garage door opening mechanism.

Another aspect of the present invention provides a garage door opening mechanism having a transmission drive sensing capability to determine the amount of force applied to a garage door by the garage door opening mechanism.

One other aspect of the present invention provides a force sensing module, or kit, adapted to be added to an existing assisted garage door opening mechanism to enable determining the amount of force applied to a garage door by the garage door opening mechanism.

An aspect of the present invention provides a method for determining the amount of force applied on a closed garage door by an assisted garage door opening mechanism and preventing the assisted garage door opening mechanism to open the garage door when the amount of force applied on the garage door exceeds a predetermined threshold.

Another aspect of the present invention provides a method for sensing the amount of slack in a transmission member to determine the amount of force transmitted to the garage door and prevents the garage door from being opened if the amount of slack in the transmission member exceeds a predetermined slack threshold.

Therefore, in accordance with the present invention, there is provided a garage door opening module comprising: a power unit having a rotatable output drive, the power unit being adapted to move the garage door when the power unit is used in conjunction with the garage door; an endless transmission drive adapted to transfer movement from the rotatable output drive to a door drive; and a sensor mechanism positioned along the endless transmission drive and adapted to sense a transmission drive slack, the sensor mechanism adapted to stop a movement of the door drive when a transmission drive slack displacement threshold is reached.

Also in accordance with the present invention, there is provided a method for actuating a garage door, the method comprising: powering a power unit adapted to open and close a garage door; sensing a slack in an endless transmission drive transmitting movement between the power unit and the garage door; and sending a signal adapted to stop moving the garage door when the slack in the transmission drive is less than a predetermined slack threshold.

Further in accordance with the present invention, there is provided a sensor module for preventing movements of an assisted garage door, the sensor module comprising: a sensor adapted to be in electrical communication with a power unit; a support bracket adapted to position the sensor about an endless transmission drive transmitting movement from the power unit to the garage door; and a contacting member adapted to contact the endless transmission drive, the sensor being adapted to prevent an assisted movement of the garage door when the sensor reaches a predetermined endless transmission drive slack threshold.

Throughout the present specification the following terms are generally used with their following associated meaning:

1. Slack: Stroke, looseness or play in an endless transmission drive, like a chain or a belt for example, measured between two sprockets or sheaves. The amplitude of the stroke is determined by moving the endless transmission

drive, at some place between the sprockets or sheaves, orthogonally in respect of a tangent line between the two sprockets. The amplitude is defined by a length.

2. Sensor: A device that responds to a physical stimulus and transmits a resulting impulse or a resulting change of state. Could be normally opened or normally closed depending on the specific purpose and the installation of the sensor.
3. Threshold: A level at which the sensor begins to send an impulse or changes of state. The threshold can be selected and adjusted according to a desired physical arrangement.

Embodiments of the present invention do not necessarily have all of the above-mentioned objects and/or aspects.

Additional and/or alternative features, aspects, and advantages of the embodiments of the present invention will become apparent from the following description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the invention will become more apparent in the following detailed description in which reference is made to the appended drawings, wherein:

FIG. **1** is a perspective view of a first embodiment of a garage door with an assisted garage door opening mechanism in a non-actuated state;

FIG. **2** is a magnified perspective view of the assisted garage door opening mechanism of FIG. **1**;

FIG. **3** is an elevational view taken from the left side of the assisted garage door mechanism of FIG. **1**;

FIG. **4** is an elevational view taken from the right side of the isolated assisted garage door mechanism of FIG. **1**;

FIG. **5** is an elevational view taken from the left side of the isolated assisted garage door mechanism of FIG. **1**;

FIG. **6** is a perspective view of the garage door of FIG. **1** with the assisted garage door opening mechanism in an actuated state;

FIG. **7** is a magnified perspective view of the assisted garage door opening mechanism of FIG. **6**;

FIG. **8** is an elevational view taken from the right side of the assisted garage door mechanism of FIG. **6**;

FIG. **9** is an elevational view taken from the left side of the isolated assisted garage door mechanism of FIG. **6**;

FIG. **10** is a perspective view of a second embodiment of a garage door with an assisted garage door opening mechanism in a non-actuated state;

FIG. **11** is an elevational view taken from the right side of the isolated assisted garage door mechanism of FIG. **10** in a non actuated state;

FIG. **12** is a magnified perspective view of the assisted garage door opening mechanism of FIG. **10** in a non-actuated state;

FIG. **13** is an elevational view taken from the right side of the isolated assisted garage door mechanism of FIG. **10** in an actuated state;

FIG. **14** is a magnified perspective view of a second embodiment of a garage door with an assisted garage door opening mechanism in an actuated state;

FIG. **15** is a perspective view of a third embodiment of a garage door with an assisted garage door opening mechanism in a non-actuated state;

FIG. **16** is an elevational view of the assisted garage door opening mechanism of FIG. **15** taken from the left side;

FIG. **17** is a magnified perspective view taken of the assisted garage door mechanism of FIG. **15**;

FIG. **18** is an elevational view taken from the left side of the isolated assisted garage door mechanism of FIG. **15** in an actuated state; and

FIG. **19** is a magnified perspective view of the assisted garage door mechanism of FIG. **15** in an actuated state.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS OF THE INVENTION

The preferred embodiment illustrated in the Figures is one possible mechanical arrangement among other workable variations. These other workable variations are not considered to be enough materially distinctive so that a person skilled in the art of assisted garage door would not know how to adapt the present invention thereto.

FIG. **1** illustrates a garage door assembly **10** with a garage door **12** adapted for moving up **14** and down **16** along side guides **18**. The illustrated garage door **12** is designed such that it rolls in an overhead space **20** about roll axis **22** to reduce the space taken by the garage door **12** when the garage door **12** is open. A garage door protector **24** prevents dirt and foreign objects to interfere with the rolled garage door **12**. Other ways of storing an opened garage door are well known in the art and will not be described in the instant patent application given their limited influence on the present invention.

A manual locking mechanism **30** can be appreciated on FIG. **1**. A rod **32** (or a deadbolt) is slidably maintained to the garage door **12** by a fixed member **34** connected to the garage door **12**. The rod **32** is adapted to engage a corresponding opening (not visible on FIG. **1**) provided in the side guide **18**. A lateral actuation **36** selectively engages and disengages the rod **32** to/from the side guide **18** to prevent opening of the garage door **12** and allow opening of the garage door **12**, respectively. Two manual locking mechanisms **30** are displayed on the garage door **12** to ensure both sides of the garage door **12** are secured to their associated side guides **18**.

Still on FIG. **1**, a garage door opening mechanism **40** is illustrated. The garage door opening mechanism **40** is installed next to the garage door **12** and assists opening of the garage door **12**. The illustrated garage door mechanism **40** is disposed on one side of the garage door **12** but could perfectly be located anywhere next to the garage door **12** as long as the garage door opening mechanism **40** can be operatively connected to the garage door **12** without departing from the scope of the present invention. The garage door opening mechanism **40** could perfectly be located on the opposite side of the garage door protector **24** as it will be described later.

The disclosed embodiment depicts a garage door opening mechanism **40** cooperating with a "roll-up" type garage door **12** (i.e. the opened garage door is stored in a roll shape). The garage door opening mechanism **40** used to enable movement to the garage door **12** can be operatively installed to a different type of garage door **12** (e.g. sectional garage door or fabric garage door) and still remain within the scope of the present invention.

A power unit **42** is fastened on a power unit support **44** that is affixed to the garage door protector **24**. The power unit **42** of the illustrated embodiment is an electric motor that preferably works on domestic or industrial power supply (e.g. AC~120, 220 or 550 Volts). The power unit **42** has a rotatable power output member (not visible on FIG. **1**) that transfers rotatative movement from the power unit **42** to a gearbox **46**. The gearbox **46** changes the ratio of the final output drive **48** (e.g. the number of rotation-per-minute, or RPM) before it is operatively connected to the garage door **12** to actuate the garage door **12**. Other types of mechanical drives, including other types of gear or belt mechanisms, suitable to change the output ratio of the power unit **42**, or not, could be used without affecting the principles of the present invention.

Rotational speed reduction of the power unit **42** proportionally increases the torque produced by the power unit **42**. The increased torque allows opening a significantly heavy garage door **12** with a power unit **42** of relative small size while reducing the speed of the garage door **12** movement.

As best seen on FIG. **2**, that is a magnified view of a portion of FIG. **1**, the final output drive **48** illustrated in the present invention uses a sprocket **50** adapted to interact with an endless transmission drive **60** to transfer movement to the garage door **12**. In the present embodiment the endless transmission drive **60** is illustratively a chain drive. A person skilled in the art would understand a belt drive (not shown in the Figures but some examples can be found on http://en.wikipedia.org/wiki/Belt_(mechanical)) could be used to transfer movement from the final output drive **48** to the garage door **12** via door drive **62**. An electric box **58** is also depicted on FIG. **2**. The electric box **58** provides a secured volume for connecting the electric wires to power the power unit **42**.

A secondary chain **52**, or chain hoist, is operatively connected to a secondary sprocket **54** to manually actuate the garage door **12**. The manual actuation of the garage door **12** can overrule the movement that should be enabled by the power unit **42** to manually open the garage door **12** when, for example, there is a grid power failure. The secondary chain **52**, when manually pulled down in one direction, rotates the secondary sprocket **54** about the secondary axis **56**. The secondary axis **56** transfers the rotational movement to the gearbox **46** to move the garage door **12** via rotation of the final output drive **48**.

The endless transmission drive **60** interconnects the final output drive **48** to the door drive **62** with intervening sprockets **50**, **64**, rotating about their respective axes **49**, **66**. The sprockets **50**, **64**, can be of different sizes to provide further ratio adjustment in addition to the gearbox **46**. A support plate **68** is interconnecting the cantilever end of the final output drive **48** with the cantilever end of the door drive **62** to increase rigidity of the assembly. Intervening bearings **72** are provided to both the final output drive **48** and the door drive **62** to rotate about the support plate **68**. Adjustment slots **70** are provided to change the length of the support plate **68** and adapt the support plate **68** to a different axes **49**, **66** layout. The length of the support plate **68** is secured by fasteners **104**.

Direct Sensor Mechanism—Door Moving Upward

FIGS. **1** through **9** illustrate a sensor mechanism **100** directly disposed on the endless transmission drive **60** and secured to the garage door assembly **10**. FIGS. **1** through **5** depict the direct sensor mechanism **100** in a non actuated state while FIGS. **6** through **9** depict the direct sensor mechanism **100** in an actuated state. The latter case will be discussed later in the specification.

The direct sensor mechanism **100** is used to determine the amount of slack **74** (best seen on FIG. **4**) in the endless transmission drive **60** to infer the resistance provided by the garage door **12** when the power unit **42** applies motion to the garage door **12**. The tension in the endless transmission drive **60** will not be significant enough to actuate the direct sensor mechanism **100** if motion is applied by the power unit **42** and the garage door **12** is free to move up. In contrast, if the garage door is manually locked with the locking mechanism **30**, the garage door **12** cannot move up under the action of the power unit **42** and this will enable an increased tension in the endless transmission drive **42** that will actuate the direct sensor mechanism **100**.

As best seen on FIGS. **2** through **5**, the direct sensor mechanism **100** is illustratively fastened to the support plate **68** via a direct sensor fixed bracket **102**. The direct sensor fixed bracket **102** is fastened to the support plate **68** with a series of fasteners **104**. Alternatively, the direct sensor fixed bracket **102** could be connected to the garage door protector **24** or connected to any structure suitable to maintain it adequately in cooperation with the endless transmission drive **60**. Further, referring now more specifically to FIG. **4**, the direct sensor mechanism **100** comprises a sensor frame **106** slidably mounted to the support plate **68** and/or to the direct support fixed bracket **102**. The slidable capability **110** is provided by slots **108** allowing movements about some fasteners **113** acting as guides. This slidable capability **110** of the sensor frame **106** allows the bearing member **128** to move in conjunction with the endless transmission drive **60** slack **74**. The shape of the direct sensor fixed bracket **102** provides additional guides **126** ensuring proper linear movement of the sensor frame **106** in respect to the parts that remain fixed. The sensor frame **106** is biased toward the endless transmission drive **60** and follows the endless transmission drive **60** notwithstanding the amount of slack **74** in the endless transmission drive **60**. It is understood that the sensor frame **106** has a limited stroke about the fixed bracket **102** but that stroke is proportional to the normally expected range of slack **74** in the endless transmission drive **60**.

The bearing member **128** depicted in this embodiment is a circular bearing member that is adapted to rotate with the motion (i.e. linear displacement) of the endless transmission drive **60**. A non-rotatable bearing member **128** made of low friction material (e.g. Teflon™) could perform a similar function and is also encompassed by the instant application.

The sensor frame **106** is biased toward the endless transmission drive **60** with a spring **112** that is guided by a guide member **114** fixedly fastened to the direct sensor fixed bracket **102**. The preload provided by the spring **112** to the sensor frame **106** applies pressure on the endless transmission drive **60** through the bearing member **128**. The bearing member **128** provides minimum tension in the endless transmission drive **60** while recuperating the slack **74** in the endless transmission drive **60**. The tension provided by the spring **112** can be adjusted by preloading the spring **112** by turning the nut **116**. Increasing the spring **112** preload proportionally increases the amount of force needed to activate the direct sensor mechanism **100**. One practical effect of increasing the preload is to adjust the sensor **120** threshold to a heavier garage door **12** or a garage door **12** that is simply harder to open.

The movement of the sensor frame **106** is limited by an adjustable stopper **118** connected thereto and abutting the direct sensor fixed bracket **102** at the end of the sensor frame **106** permitted travel. A sensor **120** is connected to the sensor frame **106** and is actuated by a sensor lever **122** contacting the direct sensor fixed bracket **102**. The exact level at which the sensor **120** will react can be tuned by changing the position of the lever contact member **124** that optionally intervenes between the direct sensor fixed bracket **102** and the sensor lever **122**.

The final output drive **48** rotates in two directions. A first direction, as indicated by arrow **80**, moves the garage door **12** upward, conversely, rotation of the final output drive in the opposite direction, indicated by arrow **82**, moves the garage door **12** downward. The direct sensor mechanism **100** is contacting the transmission drive **60** segment (i.e. the portion of transmission drive **60** between two sprockets **50**, **64**) that is tensioned when the garage door **12** is moved upward. In the event the garage door **12** is locked with the locking mechanism **30** the garage door opening mechanism **40** is going to apply significantly more tension in the endless transmission drive **60** then it normally has to. The direct sensor mechanism **100**, that is building a predetermined amount of tension on the endless transmission drive **60**, is positioned by the slack **74** in the endless transmission drive **60**. Referring now to FIGS. **6** through **9**, when the tension increases in the endless transmission drive **60**, because the garage door **12** cannot move upward as easily as it is supposed to normally do, the sensor frame **106** is pushed by the endless transmission drive **60** and the sensor **102** is activated if the stroke **129** is significant enough to move beyond the sensor **102** threshold. In the present situation the switch lever **122** is moved down **130** with the stroke **129**.

When the sensor **102** threshold is reached the sensor **102** cuts the power input of the power unit **42** in the case the sensor **102** is used on the power electrical circuit. Conversely, the sensor **102** sends a signal or cut the control circuit, thus providing a signal, if the sensor **102** is applied to a control electrical circuit. The control electrical circuit will act on the power electrical circuit and stop the power unit **42**. In both situations the power unit **42** will not open the garage door **12**.

Optionally, the direct sensor mechanism **100** could be used with a clutch (not shown) or another kind of power dissipation means adapted to prevent movement of the garage door **12**.

Lever Sensor Mechanism—Door Moving Upward

Another embodiment is illustrated in FIGS. **10** through **14**. This embodiment is different from the previous embodiment because a lever **202** provides the actuation of the sensor **120**. The garage door opening mechanism **40** is located on the other side of the garage door assembly **10** and includes an additional intervening chain **208** is disposed between the power unit **42** and the sprocket **50**. Similarly with the previous embodiment, the actuation of the sensor **120** is provided when the door is moved upward to open the garage door **12**. FIGS. **10** through **12** depict the lever sensor mechanism **200** in a non actuated state while FIGS. **13** and **14** depict the lever sensor mechanism **200** in an actuated state.

In this embodiment the increased tension in the endless transmission drive **60** will actuate the lever sensor mechanism **200** when the door is opened with resistance.

The lever sensor mechanism **200** is used to determine the amount of slack **74** in the endless transmission drive **60** to infer the resistance provided by the garage door **12** when the power unit **42** applies a movement to the garage door **12**. The tension in the endless transmission drive **60** will not be significant enough to actuate the lever sensor mechanism **200** when the movement is applied by the power unit **42** to a garage door **12** that is free to move up.

As seen on FIGS. **10** through **12**, the lever **202** is pivoting about the sprocket axis **49** and contacts one side of the endless transmission drive **60** via a bearing member **128**. The position of the bearing member **128** on the lever **202** is adjustable along a slot **204** provided in the lever **202**. This adjustment changes the length of the lever and therefore changes the amount of pressure and the contact location of the bearing member **128** on the endless transmission drive **60**. The lever **202** is curved to join the sensor **120** in its illustrated position but the shape of the lever **202** could be adapted to a different layout without departing from scope of the present invention. The bearing member **128** is similar to the bearing member **128** of the direct sensor mechanism **100** described above and is used to contact the endless transmission drive **60** to determine the amount of slack **74** in the endless transmission drive **60**.

The lever **202** is biased toward the endless transmission drive **60** and follows its movements notwithstanding the amount of slack **74** in the endless transmission drive **60**. It is understood the lever **202** has a limited angular stroke but that angular stroke is proportional to the normally expected slack **74** in the endless transmission drive **60** in the course of normal operations.

The bearing member **128** depicted in this embodiment is a circular bearing member **128** that rotates with the linear displacement of the endless transmission drive **60**. A fixed bearing member **128** made of low friction material is also encompassed by the instant application.

The sensor **120** is fixedly connected to an arbitrary structure in the neighbourhood of the other pivot **202** end. In the present situation the sensor **120** is connected to the electrical box **58** via a bracket **206**. The bearing member **128** is biased toward the endless transmission drive **60** by a spring **112** applying a force on the lever **202**. The spring **112** is guided by a guide member **114** fixedly fastened to the bracket **206**. The preload provided by the spring **112** to the pivot **202** applies pressure on the endless transmission drive **60** providing a minimum of tension in the endless transmission drive **60** thus recuperating the slack **74** from the endless transmission drive **60**. The force provided by the spring **112** can be adjusted by preloading the spring **112** with the nut **116**. By increasing the spring **112** preload one will prevent the lever sensor mechanism **200** to be activated by the sole weight of a heavy garage door **12** or a garage door **12** that is simply normally difficult to open.

The movement of the pivot **202** can optionally be limited by an optional adjustable stopper (not shown) disposed on the bracket **206** and abutting the lever **202** at the end of the permitted travel. The sensor **120** is connected to the bracket **206** and is actuated by a sensor lever **122** contacting the lever **202**. The threshold at which the sensor **120** will react could be tuned by changing the position of a lever contact member **124** that optionally intervenes with the sensor lever **122**.

The final output drive **48** of the power unit **42** rotates in two directions. A first direction, as indicated by arrow **82**, moves the garage door **12** upward. Conversely, rotation of the final output drive **48** in the opposite direction, indicated by arrow **80**, moves the garage door **12** upward. In the event the garage door **12** is encountering difficulties on its travel up, the power unit **42** will apply significantly more tension in the endless transmission drive **60** then it normally has to. The lever sensor mechanism **200**, that is building a predetermined force on the endless transmission drive **60**, is positioned by the slack **74** in the endless transmission drive **60**. Referring now to FIGS. **13** and **14**, when tension increases in the endless transmission drive **60**, because the garage door **12** cannot move upward as easily as it is supposed to normally do, the lever **202** is pushed by the endless transmission drive **60** and the sensor **102** is activated if the angular stroke is significant enough to move beyond the sensor **102** threshold. It has to be noted that, in the present embodiment, actuation of the sensor **102** happens when the sensor **102** is at rest and the sensor lever **122** is not pushed.

When the sensor **102** threshold is reached the sensor **102** cuts the power going to the power unit in the case the sensor **102** is used on a power circuit. In contrast, the sensor **102** sends a signal or opens the electrical circuit if the sensor **102** is applied to a control electrical circuit. The control electrical circuit will act on the power electrical circuit in the latter case. In both situations the power unit **42** will stop opening the garage door **12**.

Additionally, the lever sensor mechanism **200** could be used with a clutch (not shown) or another kind of power dissipation means preventing movement of the garage door **12**.

Lever Sensor Mechanism—Door Moving Downward

Another alternate embodiment is illustrated in FIGS. **15** through **19**. This embodiment differs from the first two embodiments because the sensor **120** is actuated when the door is moved downward to close the garage door **12**. FIGS. **15** through **17** depict the lever sensor mechanism **200** in a non actuated state while FIGS. **18** and **19** depict the lever sensor mechanism **200** in an actuated state.

In this embodiment the increased tension in the endless transmission drive **60** will actuate the lever sensor mechanism **200** when the door is lowered with resistance. This is an additional safety feature in case the garage door **12** encounters a restriction when moved down.

Here again the lever sensor mechanism **200** is used to determine the amount of slack **74** in the endless transmission drive **60** to infer the resistance provided by the garage door **12** when the power unit **42** applies a movement to the garage door **12**. The tension in the endless transmission drive **60** will not be significant enough to actuate the direct sensor mechanism **100** if the movement is applied by the power unit **42** to a garage door **12** that is free to move down.

As seen on FIGS. **10** through **12**, the lever **202** is pivoting about the sprocket axis **49** and contacts one side of the endless transmission drive **60** via a bearing member **128**. The position of the bearing member **128** on the lever **202** is adjustable along a slot **204** provided in the lever **202**. This adjustment changes the length of the lever and therefore changes the amount of pressure and the contact location of the bearing member **128** on the endless transmission drive **60**. The lever **202** is curved to join the sensor **120** in its illustrated position but the shape of the lever **202** could be adapted to a different layout without departing from scope of the present invention. The bearing member **128** is similar to the bearing member **128** of the direct sensor mechanism **100** described above and is used to contact the endless transmission drive **60** to determine the amount of slack **74** in the endless transmission drive **60**.

The lever **202** is biased toward the endless transmission drive **60** and follows its movements notwithstanding the amount of slack **74** in the endless transmission drive **60**. It is understood the lever **202** has a limited angular stroke but that angular stroke is proportional to the normally expected slack **74** in the endless transmission drive **60**.

The bearing member **128** depicted in this embodiment is a circular bearing member **128** that rotates with the linear displacement of the endless transmission drive **60**. A fixed bearing member **128** made of low friction material is also encompassed by the instant application.

The sensor **120** is fixedly connected to an arbitrary structure in the neighbourhood of the other pivot **202** end. In the present situation the sensor **120** is connected to the electrical box **58** via a bracket **206**. The bearing member **128** is biased toward the endless transmission drive **60** by a spring **112** applying a force on the lever **202**. The spring **112** is guided by a guide member **114** fixedly fastened to the bracket **206**. The preload provided by the spring **112** to the pivot **202** applies a force on the endless transmission drive **60** providing a minimum of tension in the endless transmission drive **60** thus recuperating the slack **74** from the endless transmission drive **60**. The force provided by the spring **112** can be adjusted by preloading the spring **112** with the nut **116**. By increasing the spring **112** preload one will prevent the lever sensor mechanism **200** to be activated by the sole weight of a heavy garage door **12** or a garage door **12** that is simply normally difficult to close.

The movement of the pivot **202** can optionally be limited by an adjustable stopper (not shown) disposed on the bracket **206** and abutting the lever **202** at the end of the permitted travel. The sensor **120** is connected to the bracket **206** and is actuated by a sensor lever **122** contacting the lever **202**. The threshold at which the sensor **120** will react could be tuned by changing the position of a lever contact member **124** that optionally intervenes with the sensor lever **122**.

The final output drive **48** of the power unit **42** rotates in two directions. A first direction, as indicated by arrow **80**, moves the garage door **12** upward. Conversely, rotation of the final output drive **48** in the opposite direction, indicated by arrow **82**, moves the garage door **12** upward. In the event the garage door **12** is encountering an object on its travel down the power unit **42** will apply significantly more tension in the endless transmission drive **60** that it normally has to. The lever sensor mechanism **200**, that is building a predetermined amount of tension on the endless transmission drive **60**, is positioned by the slack **74** in the endless transmission drive **60**. Referring now to FIGS. **13** and **14**, when tension increases in the endless transmission drive **60**, because the garage door **12** cannot move downward as easily as it is supposed to normally do, the lever **202** is pushed by the endless transmission drive **60** and the sensor **102** is activated if the stroke **74** is significant enough to move beyond the sensor **102** threshold. It has to be noted that in the present embodiment actuation of the sensor **102** happens when the sensor **102** is at rest and the sensor lever **122** is not pushed.

When the sensor **102** threshold is reached the sensor **102** cuts the power going to the power unit in the case the sensor **102** is used on a power circuit. Conversely, the sensor **102** sends a signal or opens the electrical circuit if the sensor **102** is applied to a control electrical circuit. The control electrical circuit will act on the power electrical circuit in the latter case. In both situations the power unit **42** will stop closing the garage door **12**.

Additionally, the lever sensor mechanism **200** could be used with a clutch (not shown) or another kind of power dissipation means preventing movement of the garage door **12**.

Although the invention has been described with reference to certain specific embodiments, various modifications and improvements thereof will be apparent to those skilled in the art without departing from the spirit and scope of the invention as outlined in the claims appended hereto. The entire disclosures of all references recited above are incorporated herein by reference.

I claim:

1. A garage door opening module comprising:

a power unit having a rotatable output drive, the power unit being adapted to move a garage door when the power unit is used in conjunction with the garage door;

an endless transmission drive adapted to transfer movement from the rotatable output drive to a door drive;

a locking mechanism adapted to manually lock the garage door in a closed position, the locking mechanism causing an increased tension in the endless transmission drive when the power unit moves the garage door while the locking mechanism manually locks the garage door in the closed position; and

a sensor mechanism positioned along the endless transmission drive and adapted to sense a transmission drive slack, the sensor being in a non-actuated state when the tension of the endless transmission drive is below a transmission drive slack displacement threshold and being actuated when the tension in the endless transmission drive is increased to reach the transmission drive slack displacement threshold due to the power unit moving the garage door while the locking mechanism manually locks the garage door in the closed position, the sensor mechanism stopping a movement of the door drive when in the actuated state.

2. The garage door opening module of claim **1**, wherein the endless transmission drive comprises a first transmission drive segment and a second transmission drive segment, the first transmission drive segment and the second transmission drive segment being disposed between the output drive and the door drive, the first transmission drive segment being in tension when the rotatable output drive rotates in a first direction and the second transmission drive segment being in tension when the rotatable output drive rotates in a second direction, the sensor mechanism being positioned along one of the transmission drive segments.

3. The garage door opening module of claim **2**, wherein the sensor mechanism is held in position with a bracket providing a sensor adjustment mechanism to change the position of the sensor mechanism about one of the transmission drive segments.

4. The garage door opening module of claim **2**, wherein the sensor mechanism is biased toward one of the transmission drive segments and acts as a tensioner to the transmission drive.

5. The garage door opening module of claim **4**, wherein the sensor mechanism is adjustably biased to adjust a tension applied on the transmission drive.

6. The garage door opening module of claim **2**, wherein the sensor mechanism comprises a bearing member adapted to contact the transmission drive.

7. The garage door opening module of claim **2**, wherein, when the garage door opening module is used in conjunction with a garage door, the rotatable output drive rotates in the first direction when the power unit moves the garage door upward and the rotatable output drive rotates in the second direction when the power unit moves the garage door downward, the sensor sensing the transmission drive slack of the first transmission drive segment.

8. The garage door opening module of claim **7**, wherein the transmission drive slack displacement threshold is measured orthogonally from the first transmission drive segment and is less than 10 millimeters.

9. The garage door opening module of claim **2**, wherein, when the garage door opening unit is used in conjunction with a garage door, the rotatable output drive rotates in the first direction when the power unit moves the garage door upward and the rotatable output drive rotates in the second direction when the power unit moves the garage door downward, the sensor sensing the transmission drive slack on the second transmission drive segment.

10. The garage door opening module of claim **9**, wherein the transmission drive slack displacement threshold is measured orthogonally from the first transmission drive segment and is less than 10 millimeters.

11. A method for actuating a garage door, with a garage door opening module comprising:

a power unit having a rotatable output drive, the power unit being adapted to move a garage door when the power unit is used in conjunction with the garage door;

an endless transmission drive adapted to transfer movement from the rotatable output drive to a door drive;

a locking mechanism adapted to manually lock the garage door in a closed position, the locking mechanism causing an increased tension in the endless transmission drive when the power unit moves the garage door while the locking mechanism manually locks the garage door in the closed position; and

a sensor mechanism positioned along the endless transmission drive and adapted to sense a transmission drive slack, the sensor being in a non-actuated state when the tension of the endless transmission drive is below a transmission drive slack displacement threshold and being actuated when the tension in the endless transmission drive is increased to reach the transmission drive slack displacement threshold due to the power unit moving the garage door while the locking mechanism manually locks the garage door in the closed position, the sensor mechanism stopping a movement of the door drive when in the actuated state, the method comprising: powering the power unit; sensing the transmission drive slack in the endless transmission drive; and sending a signal adapted to stop moving the garage door when in the actuated state.

12. The method for actuating a garage door of claim **11**, wherein the endless transmission drive is a chain drive and wherein the predetermined slack threshold is measured orthogonally from the endless transmission drive and is less than 10 millimeters.

13. The method for actuating a garage door of claim **11**, comprising biasing the sensor mechanism toward the endless transmission drive and adapted to act as a tensioner to the transmission drive.

14. The method for actuating a garage door of claim **13**, wherein the sensor mechanism is actuated by an amount of the slack in the endless transmission drive and actuates a sensor adapted to change a state of an electrical circuit material to powering the power unit.

15. The garage door opening module of claim **1**, wherein the sensor mechanism is adapted to stop the movement of the door drive upon detection of a sufficient increase in a tension of the endless transmission drive resulting from resistance to a movement of the garage door.

16. The garage door opening module of claim **1**, wherein the sensor mechanism comprises a sensor frame biased towards the endless transmission drive.

17. The garage door opening module of claim **16**, wherein the sensor frame applies pressure on the endless transmission drive through a bearing member, the bearing member providing tension in the endless transmission drive while recuperating the slack in the endless transmission drive.

18. The garage door opening module of claim **1**, wherein the sensor mechanism stops the movement of the door drive by cutting power input of the power unit.

19. The garage door opening module of claim **1**, wherein the sensor mechanism stops the movement of the door drive by sending a signal to a control electrical circuit.

20. A garage door opening module comprising:

a power unit having a rotatable output drive, the power unit being adapted to move a garage door when the power unit is used in conjunction with the garage door;

an endless transmission drive adapted to transfer movement from the rotatable output drive to a door drive;

a locking mechanism adapted to manually lock the garage door in a closed position, the locking mechanism causing an increased tension in the endless transmission drive when the power unit moves the garage door while the locking mechanism manually locks the garage door in the closed position; and

a sensor mechanism positioned along the endless transmission drive and adapted to sense a transmission drive slack, the sensor mechanism being configured to stop a movement of the door drive upon detection of a sufficient increase in a tension of the endless transmission drive resulting from the power unit moving the garage door while the locking mechanism manually locks the garage door in the closed position.

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